



TFT LCD Preliminary Specification

MODEL NO.: V470H1 - L07

Customer: _____

Approved by: _____

Note:

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CONTENTS

REVISION HISTORY	4
1. GENERAL DESCRIPTION	5
1.1 OVERVIEW	5
1.2 FEATURES	5
1.3 APPLICATION	5
1.4 GENERAL SPECIFICATIONS	5
1.5 MECHANICAL SPECIFICATIONS	6
2. ABSOLUTE MAXIMUM RATINGS	7
2.1 ELECTRICAL ABSOLUTE RATINGS	7
2.1.1 TFT LCD MODULE	7
2.2 ABSOLUTE RATINGS OF ENVIRONMENT	7
2.3 RELIABILITY TEST CONDITION	8
3. ELECTRICAL CHARACTERISTICS	9
3.1 TFT LCD MODULE	9
3.2 BACKLIGHT CONNECTOR PIN CONFIGURATION	11
3.2.1 LAMP SPECIFICATION	11
3.2.2 ELECTRICAL SPECIFICATION	11
4. BLOCK DIAGRAM OF INTERFACE	15
4.1 TFT LCD MODULE	15
5. INPUT TERMINAL PIN ASSIGNMENT	16
5.1 TFT LCD Module Input	16
5.2 BACKLIGHT UNIT	19
5.3 BLOCK DIAGRAM OF INTERFACE	20
5.4 LVDS INTERFACE	22
5.5 COLOR DATA INPUT ASSIGNMENT	23
6. INTERFACE TIMING	24
6.1 INPUT SIGNAL TIMING SPECIFICATIONS	24
6.2 POWER ON/OFF SEQUENCE	25
7. OPTICAL CHARACTERISTICS	27

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Preliminary

7.1 TEST CONDITIONS.....	27
7.2 OPTICAL SPECIFICATIONS	27
8. PRECAUTIONS.....	27
8.1 ASSEMBLY AND HANDLING PRECAUTIONS	31
8.2 SAFETY PRECAUTIONS	31
9. DEFINITION OF LABELS.....	32
9.1 CMO MODULE LABEL	32
10. PACKAGING.....	33
10.1 PACKAGING SPECIFICATIONS	33
10.2 PACKAGING METHOD.....	33
11. MECHANICAL CHARACTERISTICS	35

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Preliminary**REVISION HISTORY**

Version	Date	Page (New)	Section	Description
Ver.1.0	Dec.03'07	All	All	Preliminary Specification was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

V470H1-L07 is a 47" TFT Liquid Crystal Display module with 20-CCFL Backlight unit and 2ch-LVDS interface.

This module supports 1920 x 1080 Full HDTV format and can display true 16.7M colors (8-bit/color). The inverter module for backlight isn't built-in.

1.2 FEATURES

- High brightness (500 nits)
- High contrast ratio (2000:1)
- Fast response time (Gray to gray average 6.5 ms)
- High color saturation (NTSC 72%)
- Full HDTV (1920 x 1080 pixels) resolution, true HDTV format
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Optimized response time for 50 Hz frame rate
- Ultra wide viewing angle : Super MVA technology
- 180 degree rotation display option
- RoHS compliance

1.3 APPLICATION

- Standard Living Room TVs.
- Public Display Application.
- Home Theater Application.
- MFM Application.

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	930.24(H) x 523.26 (V) (47.02" diagonal)	mm	(1)
Bezel Opening Area	939 (H) x 531 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1920 x R.G.B. x 1080	pixel	-
Pixel Pitch(Sub Pixel)	0.1615 (H) x 0.4845 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7M	color	-
Display Operation Mode	Transmissive mode / Normally black	-	-
Surface Treatment	Anti-Glare coating / 3H	-	(2)

Note (1) Please refer to the attached drawings in chapter 9 for more information about the front and back outlines.

Note (2) The spec. of the surface treatment is temporarily for this phase. CMO reserves the rights to change this feature.

**1.5 MECHANICAL SPECIFICATIONS**

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	982.0	983.0	984.0	mm	(1), (2)
	Vertical (V)	575.0	576.0	577.0	mm	
	Depth (D)	46.3	47.3	48.3	mm	
Weight		-	12500	-	g	-

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2) Module Depth does not include connectors.



2. ABSOLUTE MAXIMUM RATINGS

2.1 ELECTRICAL ABSOLUTE RATINGS

2.1.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCC	-0.3	13.5	V	(1)
Logic Input Voltage	VIN	-0.3	3.6	V	

2.2 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	TST	-20	+60	°C	(1)
Operating Ambient Temperature	TOP	0	50	°C	(1), (2)
Shock (Non-Operating)	SNOP	-	50	G	(3), (5)
Vibration (Non-Operating)	VNOP	-	1.0	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

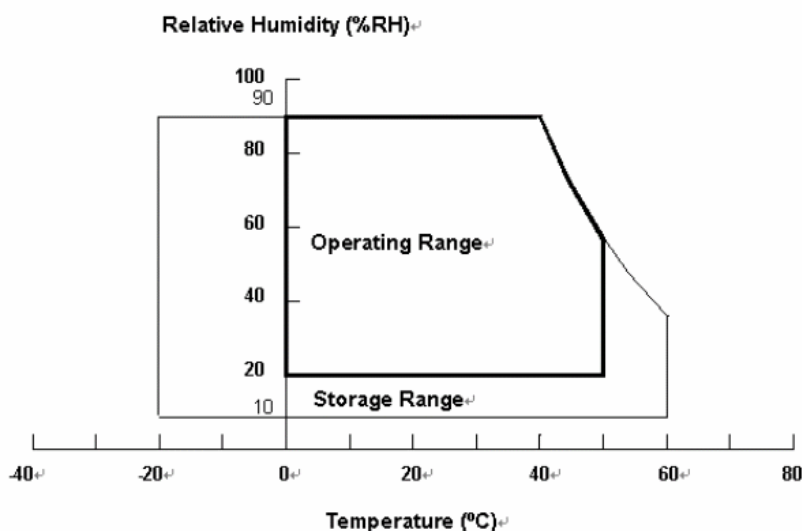
- (a) 90 %RH Max. ($T_a \leq 40\text{ }^{\circ}\text{C}$).
- (b) Wet-bulb temperature should be 39 °C Max. ($T_a > 40\text{ }^{\circ}\text{C}$).
- (c) No condensation.

Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65 °C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 °C. The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) 11 ms, half sine wave, 1 time for $\pm X$, $\pm Y$, $\pm Z$.

Note (4) 10 ~ 200 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.



2.3 RELIABILITY TEST CONDITION

No	Test Item	Codition
1	High temperature storage test	Ta = 60℃, 240hrs
2	Low temperature storage test	Ta = -20℃, 240hrs
3	High temperature high humidity storage test	Ta = 50℃, 90%RH, 240hrs
4	High temperature operation test	Ta = 50℃, 240hrs
5	Low temperature operation test	Ta = 0℃, 240hrs
6	High temperature high humidity operation test	Ta = 50℃, 80%RH, 240hrs
7	Vibration test (non-operation)	Wave form: Sine wave Vibration level: 1.0G Fre. range : 10~200Hz Duration: X, Y, Z, 10min, One time each direction
8	Shock test (non-operation)	Wave form: half sine wave Shock level: 50G ±X, ±Y, ± Z, 11ms One time each direction

3. ELECTRICAL CHARACTERISTICS

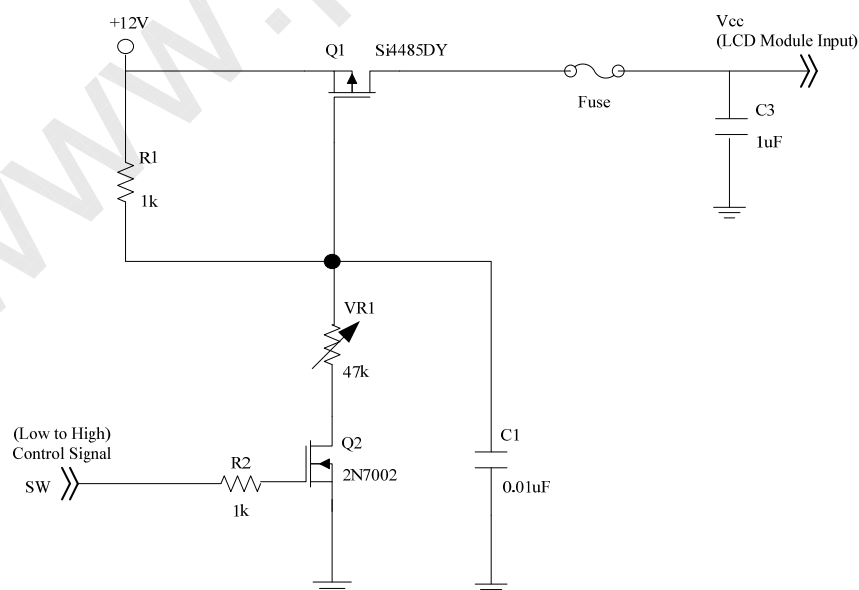
3.1 TFT LCD MODULE

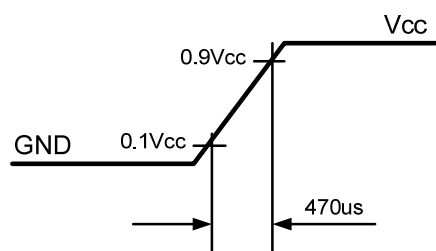
(Ta = 25 ± 2 °C)

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		VCC	10.8	12	13.2	V	(1)
Power Supply Ripple Voltage		VRP	-	-	200	mV	
Rush Current		IRUSH	-	-	4.5	A	(2)
Power Supply Current	White Pattern	-	-	1.5	2.0	A	(3)
	Mosaic Pattern	-	-	1.2	-	A	
	Black Pattern	-	-	0.6	-	A	
LVDS Interface	Differential Input High Threshold Voltage	VLVTH	-	-	100	mV	
	Differential Input Low Threshold Voltage	VLVTL	100	-	-	mV	
	Common Input Voltage	VLVC	1.125	1.25	1.375	V	
	Terminating Resistor	RT	-	100	-	ohm	
CMOS interface	Input High Threshold Voltage	VIH	2.7	-	3.3	V	
	Input Low Threshold Voltage	VIL	0	-	0.7	V	

Note (1) The module should be always operated within the above ranges.

Note (2) Measurement condition:



Vcc rising time is 470us

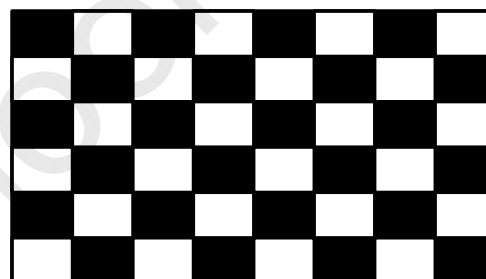
Note (3) The specified power supply current is under the conditions at $V_{cc} = 12\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 50\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



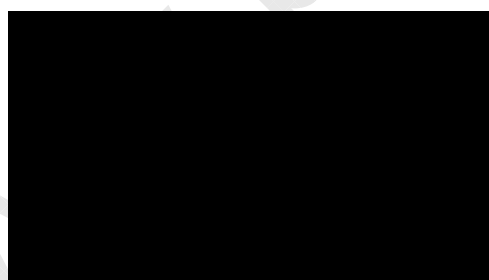
Active Area

b. Mosaic Pattern



Active Area

c. Black Pattern



Active Area

3.2 BACKLIGHT UNIT

3.2.1 CCFL (Cold Cathode Fluorescent Lamp) CHARACTERISTICS ($T_a = 25 \pm 2^\circ\text{C}$)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	-	1750	-	V_{RMS}	-
Lamp Current	I_L	5.5	6.0	6.5	mA_{RMS}	(1)
Lamp Turn On Voltage	V_S	-	-	2350	V_{RMS}	(2), $T_a = 0^\circ\text{C}$
		-	-	2150	V_{RMS}	(2), $T_a = 25^\circ\text{C}$
Operating Frequency	F_L	40	-	80	KHz	(3)
Lamp Life Time	L_{BL}	50,000	-	-	Hrs	(4)

• 3.2.2 INVERTER CHARACTERISTICS ($T_a = 25 \pm 2^\circ\text{C}$)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Consumption	P_{BL}	-	216	227	W	(3)(4), $I_L = 6.0\text{mA}$
Power Supply Voltage	V_{BL}	22.8	24	25.2	V_{DC}	
Power Supply Current	I_{BL}	-	9.0	-	A	
Input Ripple Noise	-	-	-	912	mV_{P-P}	$V_{BL}=22.8\text{V}$
Oscillating Frequency	F_W	47	45	48	kHz	
Dimming frequency	F_B	150	160	170	Hz	
Minimum Duty Ratio	D_{MIN}	-	20	-	%	

Note (1) Lamp current is measured by utilizing AC current probe and its value is average by measuring master and slave board.:

Note (2) The life time of a lamp is defined as when the brightness is larger than 50% of its original value and the effective discharge length is longer than 80% of its original length (Effective discharge length is defined as an area that has equal to or more than 70% brightness compared to the brightness at the center point of lamp.) as the time in which it continues to operate under the condition at $T_a = 25 \pm 2^\circ\text{C}$ and $I_L = 5.5 \sim 6.5\text{ mA}_{RMS}$.

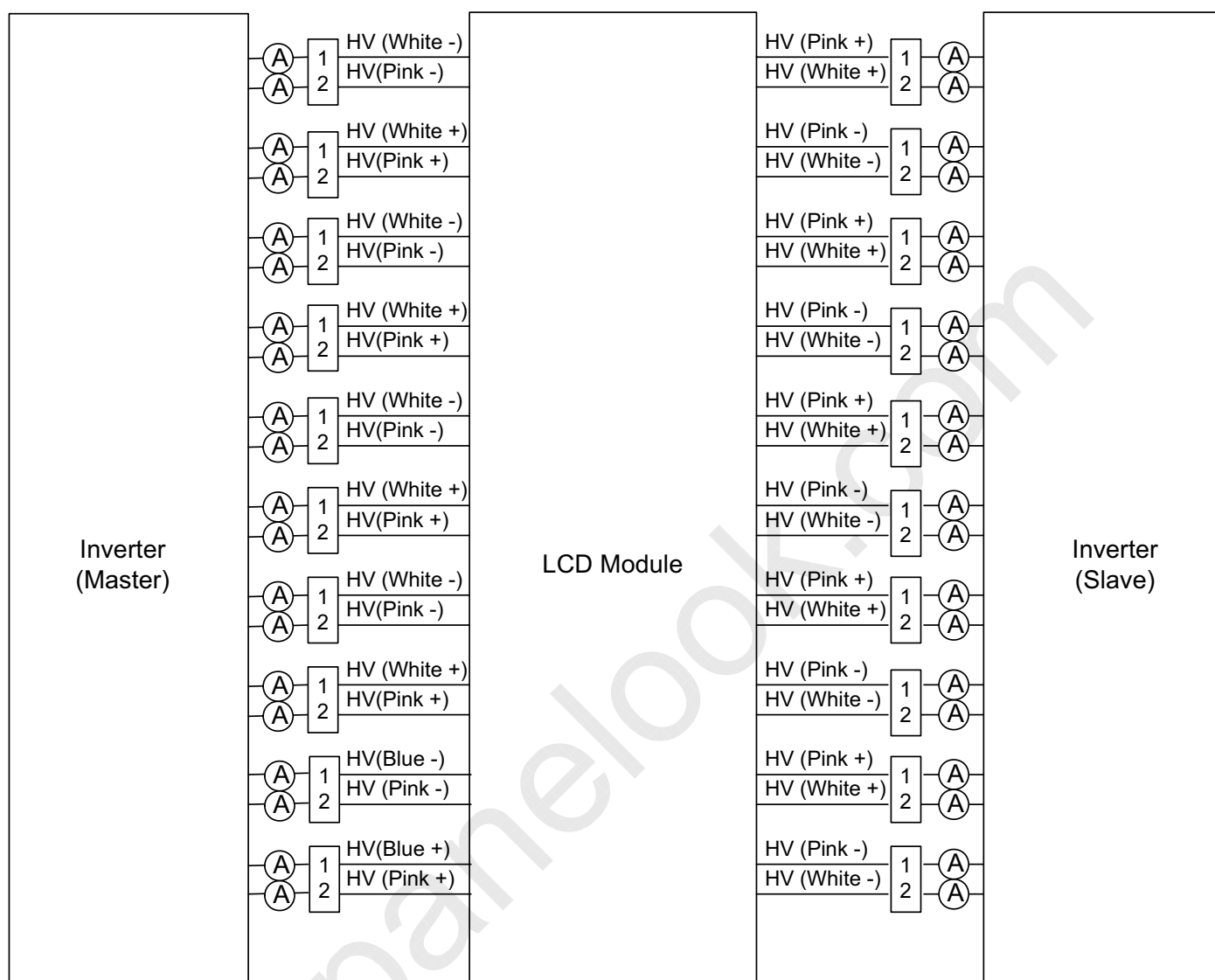
Note (3) The power supply capacity should be higher than the total inverter power consumption P_{BL} . Since the pulse width modulation (PWM) mode was applied for backlight dimming, the driving current changed as PWM duty on and off. The transient response of power supply should be considered for the changing loading when inverter dimming.

Note (4) The measurement condition of Max. value is based on 47" backlight unit under input voltage 24V, average lamp current 6.3 mA and lighting 30 minutes later.

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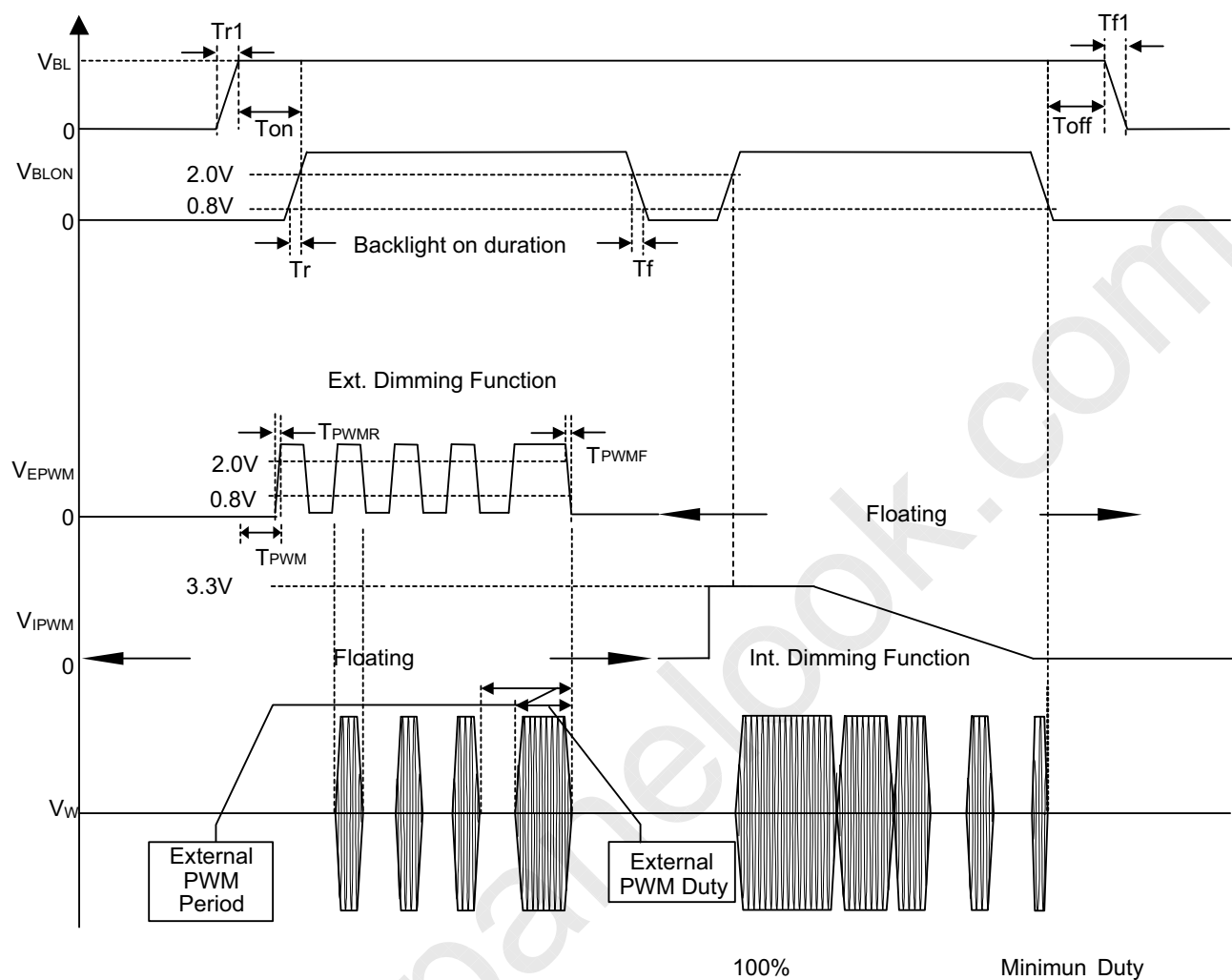
Preliminary

· 3.2.3 INVERTER INTERFACE CHARACTERISTICS

Parameter		Symbol	Test Condition	Value			Unit	Note
				Min.	Typ.	Max.		
On/Off Control Voltage	ON	V_{BLON}	—	2.0	—	5.0	V	
	OFF		—	0	—	0.8	V	
Status Signal	HI	States	—	3.0	3.3	3.6	V	Inverter Normal
	LO		—	0		0.8	V	Inverter Abnormal
Internal PWM Control Voltage	MAX	V_{IPWM}	—	2.85	3.0	3.15	V	maximum duty ratio
	MIN			—	0	—	V	minimum duty ratio
External PWM Control Voltage	HI	V_{EPWM}	—	2.0	—	5.0	V	duty on
	LO			0	—	0.8	V	duty off
VBL Rising Time		$Tr1$	—	30	—	50	ms	
VBL Falling Time		$Tf1$	—	30	—	50	ms	
Control Signal Rising Time		Tr	—	—	—	100	ms	
Control Signal Falling Time		Tf	—	—	—	100	ms	
PWM Signal Rising Time		T_{PWMR}	—	—	—	50	us	
PWM Signal Falling Time		T_{PWMF}	—	—	—	50	us	
Input impedance		R_{IN}	—	1	—	—	$M\Omega$	
PWM Delay Time		T_{PWM}	—	100		300	mS	
BLON Delay Time		T_{on}	—	300	—	500	mS	
BLON Off Time		T_{OFF}	—	300	—	500	mS	

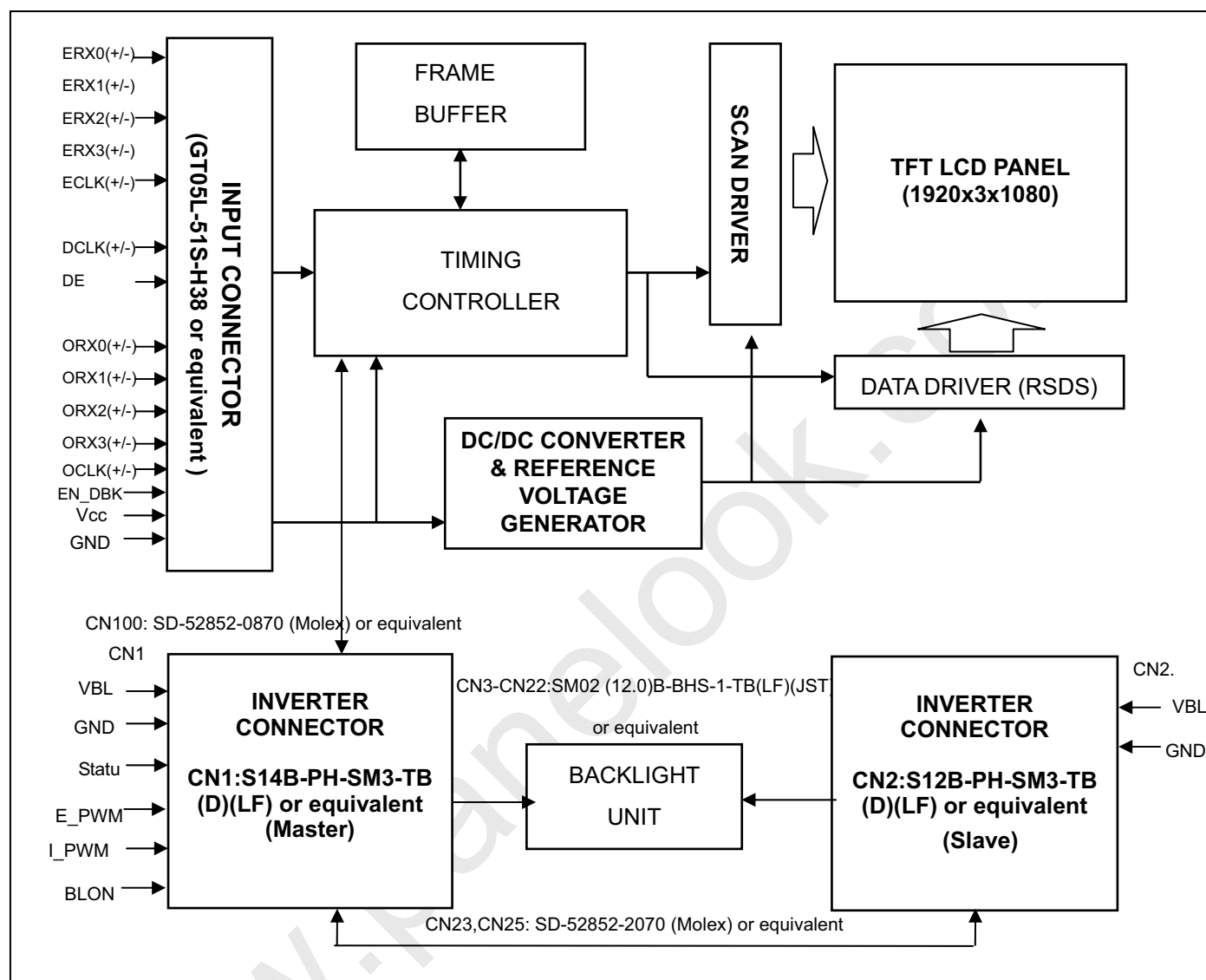
Note (2) The power sequence and control signal timing are shown in the following figure.

Note (3) The power sequence and control signal timing must follow the figure below. For a certain reason, the inverter has a possibility to be damaged with wrong power sequence and control signal timing.



4. BLOCK DIAGRAM OF INTERFACE

4.1 TFT LCD MODULE



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD Module Input

Pin	Name	Description	Note
1	N.C.	No Connection	(2)
2	N.C.	No Connection	
3	N.C.	No Connection	
4	N.C.	No Connection	
5	N.C.	No Connection	
6	N.C.	No Connection	
7	SELLVDS	LVDS data format Selection	(3)(7)
8	RPF	Display Rotation	(4)(7)
9	ODSEL	Overdrive Lookup Table Selection	(5)(7)
10	N.C.	No Connection	(2)
11	EN_DBL	Enable Dynamic Backlight	(6)(7)
12	ORX0-	Odd pixel, Negative LVDS differential data input. Channel 0	
13	ORX0+	Odd pixel, Positive LVDS differential data input. Channel 0	
14	ORX1-	Odd pixel, Negative LVDS differential data input. Channel 1	
15	ORX1+	Odd pixel, Positive LVDS differential data input. Channel 1	
16	ORX2-	Odd pixel, Negative LVDS differential data input. Channel 2	
17	ORX2+	Odd pixel, Positive LVDS differential data input. Channel 2	
18	GND	Ground	
19	OCLK-	Odd pixel, Negative LVDS differential clock input.	
20	OCLK+	Odd pixel, Positive LVDS differential clock input.	
21	GND	Ground	
22	ORX3-	Odd pixel, Negative LVDS differential data input. Channel 3	
23	ORX3+	Odd pixel, Positive LVDS differential data input. Channel 3	
24	N.C.	No Connection	(2)
25	N.C.	No Connection	(2)
26	N.C.	No Connection	(2)
27	N.C.	No Connection	(2)
28	ERX0-	Even pixel, Negative LVDS differential data input. Channel 0	
29	ERX0+	Even pixel, Positive LVDS differential data input. Channel 0	
30	ERX1-	Even pixel, Negative LVDS differential data input. Channel 1	
31	ERX1+	Even pixel, Positive LVDS differential data input. Channel 1	
32	ERX2-	Even pixel, Negative LVDS differential data input. Channel 2	
33	ERX2+	Even pixel, Positive LVDS differential data input. Channel 2	
34	GND	Ground	
35	ECLK-	Even pixel, Negative LVDS differential clock input.	
36	ECLK+	Even pixel, Positive LVDS differential clock input.	
37	GND	Ground	
38	ERX3-	Even pixel, Negative LVDS differential data input. Channel 3	
39	ERX3+	Even pixel, Positive LVDS differential data input. Channel 3	
40	N.C.	No Connection	(2)
41	N.C.	No Connection	(2)
47	N.C.	No Connection	(2)
43	N.C.	No Connection	(2)
44	GND	Ground	

45	GND	Ground	
46	GND	Ground	
47	GND	Ground	
48	VCC	Power input (+12V)	
49	VCC	Power input (+12V)	
50	VCC	Power input (+12V)	
51	VCC	Power input (+12V)	

Note (1) Reserved for internal use. Please leave it open.

Note (2) Low : normal display (Default), High : display with 180 degree rotation.

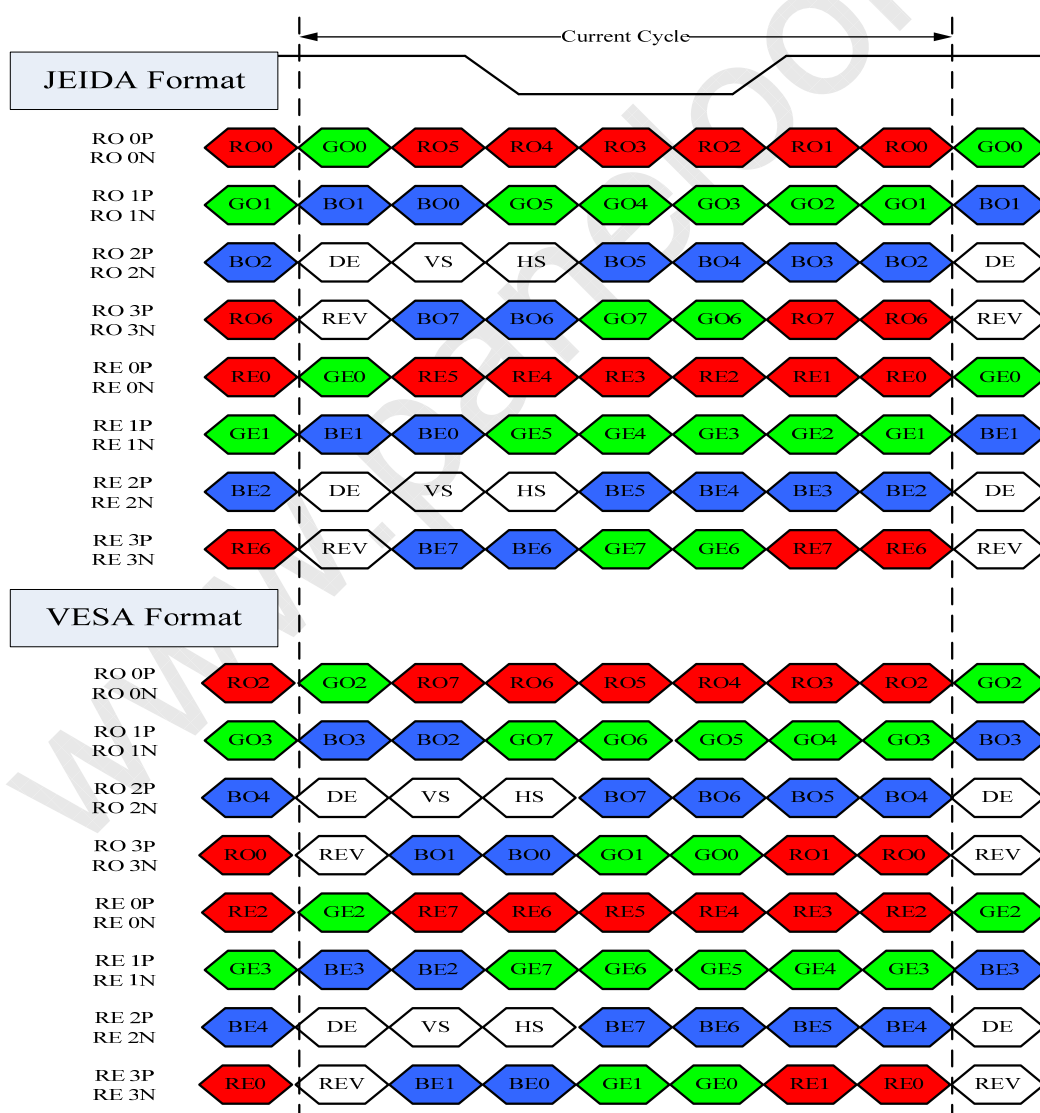


Normal Display



180° Rotation Display

Note (3) LVDS Format:





Note (4) Low : normal display (default), High : display with 180 degree rotation

Note (5) Overdrive lookup table selection. The overdrive lookup table should be selected in accordance to the frame rate to optimize image quality.

ODSEL	Note
L or NC	Lookup table was optimized for 60 Hz frame rate.
H	Lookup table was optimized for 50 Hz frame rate.

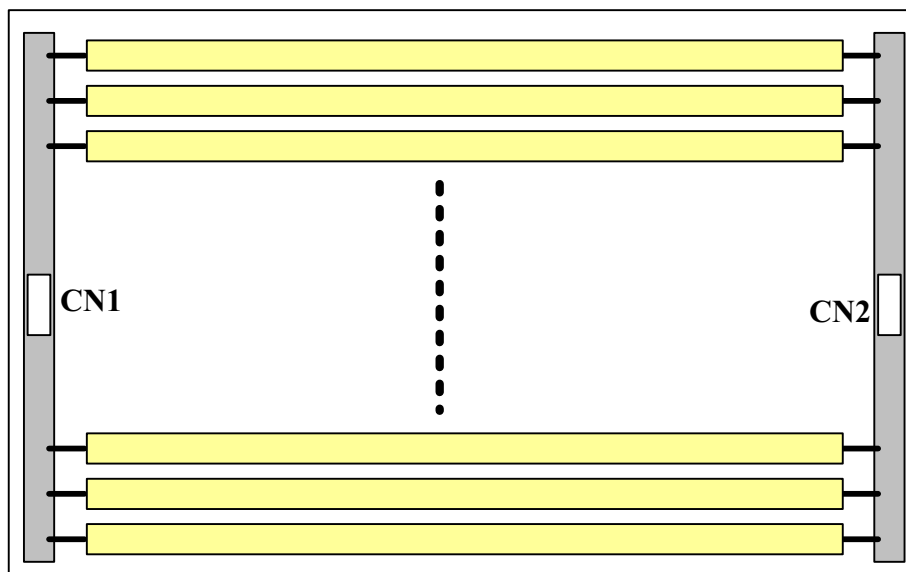
Note (6) Low : disable dynamic backlight (default), High : enable dynamic backlight function

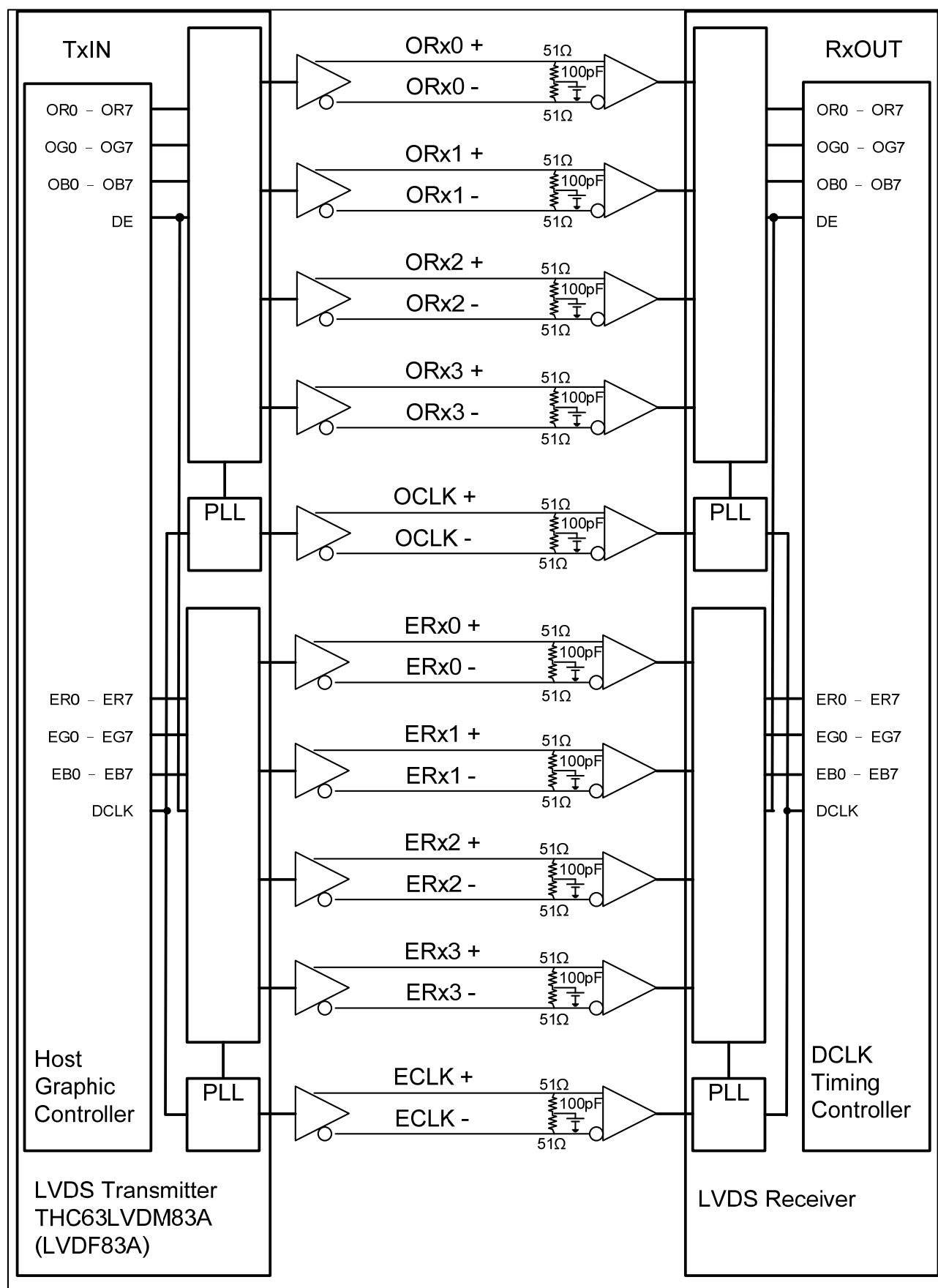
Note (7) Low = Open or connect to GND, High = Connect to +3.3V

5.2 BACKLIGHT UNIT

CN1-CN2: 65002WR-03.

Pin	Symbol	Description
1	H.V.	High Voltage for Backlight Unit
2	H.V.	High Voltage for Backlight Unit
3	N.C.	No Connection



5.3 BLOCK DIAGRAM OF INTERFACE

OR0~OR7: Odd pixel R data

OG0~OG7: Odd pixel G data

OB0~OB7: Odd pixel B data

ER0~ER7: Even pixel R data

EG0~EG7: Even pixel G data

EB0~EB7: Even pixel B data

DE: Data enable signal

DCLK: Data clock signal

Note (1) The system must have the transmitter to drive the module.

Note (2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.

Note (3) Two pixel data send into the module for every clock cycle. The first pixel of the frame is odd pixel and the second pixel is even pixel.

5.4 LVDS INTERFACE

	SIGNAL		TRANSMITTER THC63LVDM83 A		INTERFACE CONNECTOR		RECEIVER THC63LVDF84A		TFT CONTROL INPUT	
	LVDS_SEL =L or OPEN	LVDS_SEL = H	PIN	INPUT	Host	TFT-LCD	PIN	OUTPUT	LVDS_SEL =L or OPEN	LVDS_SEL = H
24 bit	R0	R2	51	TxIN0	TA OUT0+	Rx 0+	27	Rx OUT0	R0	R2
	R1	R3	52	TxIN1			29	Rx OUT1	R1	R3
	R2	R4	54	TxIN2			30	Rx OUT2	R2	R4
	R3	R5	55	TxIN3			32	Rx OUT3	R3	R5
	R4	R6	56	TxIN4	TA OUT0-	Rx 0-	33	Rx OUT4	R4	R6
	R5	R7	3	TxIN6			35	Rx OUT6	R5	R7
	G0	G2	4	TxIN7			37	Rx OUT7	G0	G2
	G1	G3	6	TxIN8			38	Rx OUT8	G1	G3
	G2	G4	7	TxIN9	TA OUT1+	Rx 1+	39	Rx OUT9	G2	G4
	G3	G5	11	TxIN12			43	Rx OUT12	G3	G5
	G4	G6	12	TxIN13			45	Rx OUT13	G4	G6
	G5	G7	14	TxIN14			46	Rx OUT14	G5	G7
	B0	B2	15	TxIN15	TA OUT1-	Rx 1-	47	Rx OUT15	B0	B2
	B1	B3	19	TxIN18			51	Rx OUT18	B1	B3
	B2	B4	20	TxIN19			53	Rx OUT19	B2	B4
	B3	B5	22	TxIN20			54	Rx OUT20	B3	B5
	B4	B6	23	TxIN21	TA OUT2+	Rx 2+	55	Rx OUT21	B4	B6
	B5	B7	24	TxIN22			1	Rx OUT22	B5	B7
	DE	DE	30	TxIN26			6	Rx OUT26	DE	DE
	R6	R0	50	TxIN27	TA OUT2-	Rx 2-	7	Rx OUT27	R6	R0
	R7	R1	2	TxIN5			34	Rx OUT5	R7	R1
	G6	G0	8	TxIN10			41	Rx OUT10	G6	G0
	G7	G1	10	TxIN11			47	Rx OUT11	G7	G1
	B6	B0	16	TxIN16	TA OUT3+	Rx 3+	49	Rx OUT16	B6	B0
	B7	B1	18	TxIN17			50	Rx OUT17	B7	B1
	RSVD 1	RSVD 1	25	TxIN23			2	Rx OUT23	NC	NC
	RSVD 2	RSVD 2	27	TxIN24	TA OUT3-	Rx 3-	3	Rx OUT24	NC	NC
	RSVD 3	RSVD 3	28	TxIN25			5	Rx OUT25	NC	NC
DCLK			31	TxCLK IN	TxCLK OUT+ TxCLK OUT-	RxCLK IN+ RxCLK IN-	26	RxCLK OUT	DCLK	

R0~R7: Pixel R Data (7; MSB, 0; LSB)

G0~G7: Pixel G Data (7; MSB, 0; LSB)

B0~B7: Pixel B Data (7; MSB, 0; LSB)

DE : Data enable signal

DCLK : Data clock signal

Notes: (1) RSVD (reserved) pins on the transmitter shall be "H" or "L"

5.5 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color.

The higher the binary input, the brighter the color. The table below provides the assignment of the color versus data input.

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of the color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red (0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	Red (253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of Green	Green (0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	Green (253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green (254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Green (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
Gray Scale Of Blue	Blue (0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	Blue (253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue (254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
Blue (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	

Note (1) 0: Low Level Voltage, 1: High Level Voltage

6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

(Ta = 25 ± 2 °C)

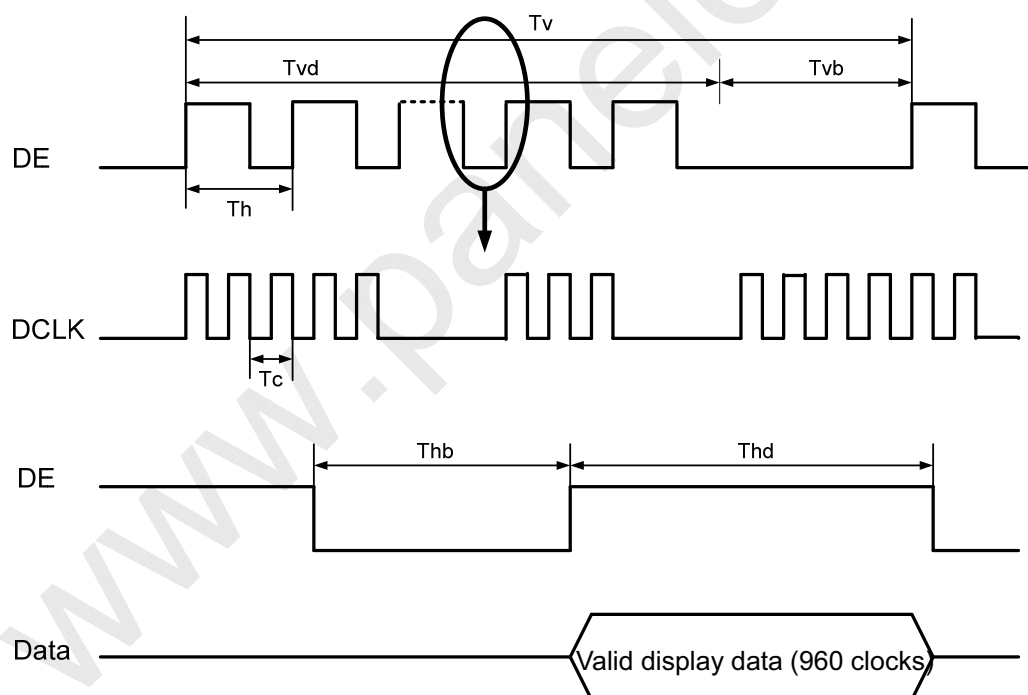
The input signal timing specifications are shown as the following table and timing diagram.

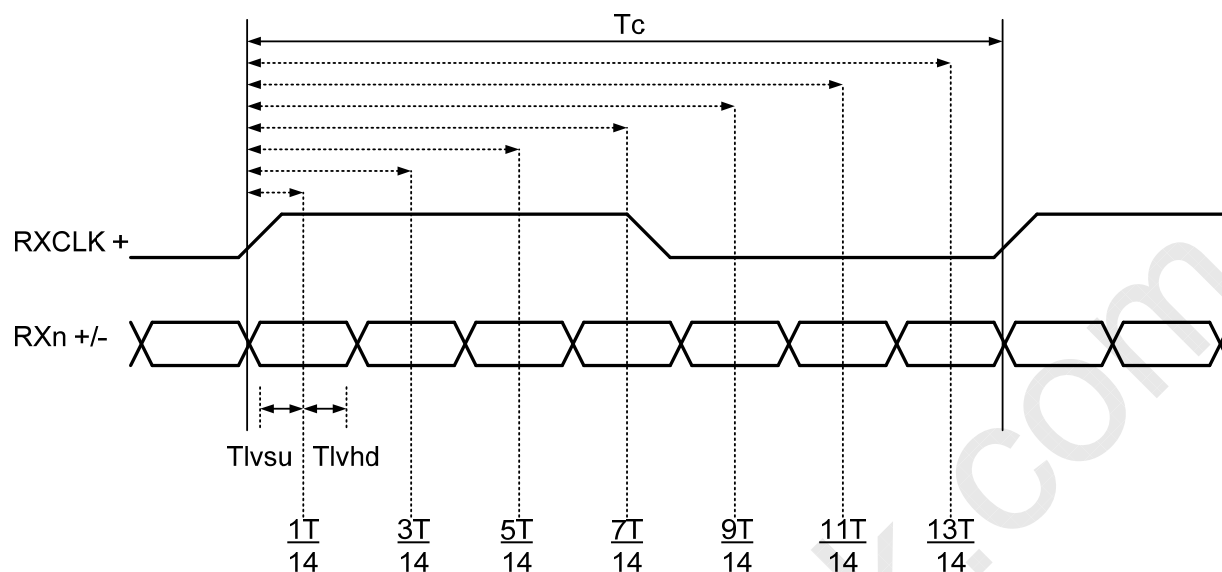
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	1/Tc	60	74	80	MHz	-
	Input cycle to cycle jitter	Trcl	-	-	200	ps	-
LVDS Receiver Data	Setup Time	Tlvsu	600	-	-	ps	-
	Hold Time	Tlvhd	600	-	-	ps	-
Vertical Active Display Term	Frame Rate	Fr5	47	50	53	Hz	(1)
		Fr6	57	60	63	Hz	(2)
	Total	Tv	1115	1125	1197	Th	Tv=Tvd+Tvb
	Display	Tvd	1080	1080	1080	Th	-
	Blank	Tvb	35	45	117	Th	-
Horizontal Active Display Term	Total	Th	1050	1100	1310	Tc	Th=Thd+Thb
	Display	Thd	960	960	960	Tc	-
	Blank	Thb	90	140	350	Tc	-

Note (1) (ODSEL) = (H). Please refer to 5.1 for detail information.

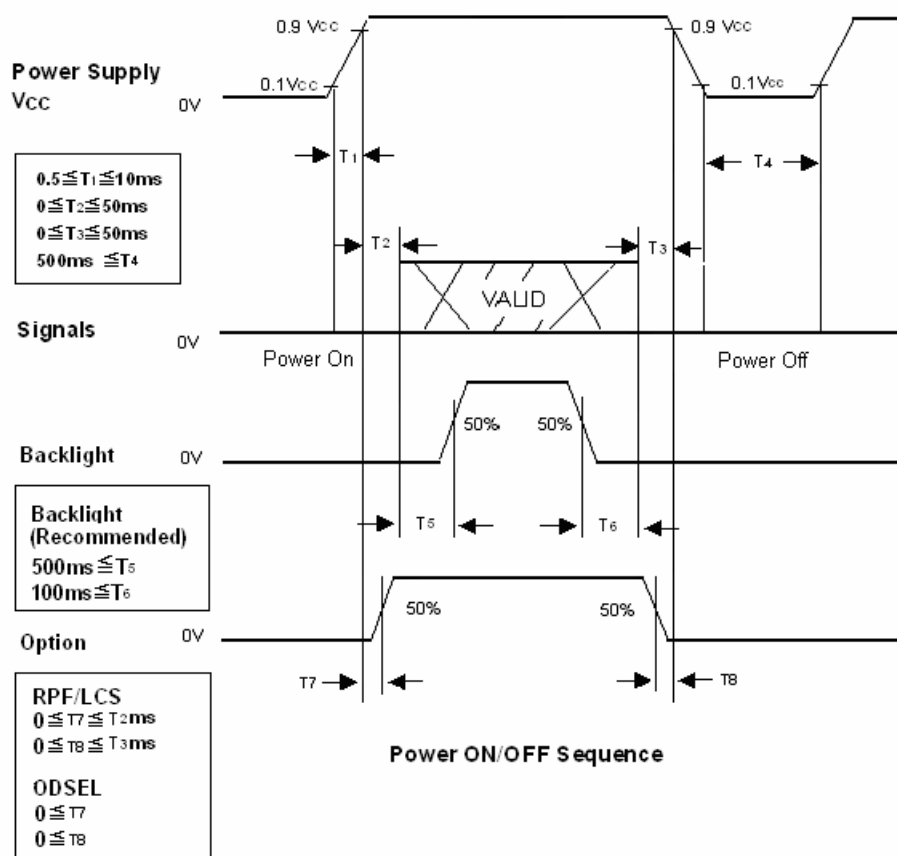
(2) (ODSEL) = (L). Please refer to 5.1 for detail information.

INPUT SIGNAL TIMING DIAGRAM



LVDS INPUT INTERFACE TIMING DIAGRAM**6.2 POWER ON/OFF SEQUENCE**

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the diagram below.



**Note.**

- (1) The supply voltage of the external system for the module input should follow the definition of Vcc.
- (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen. There is no reliability issue when the T5, T6 timing missing the range.
- (3) In case of VCC is in off level, please keep the level of input signals on the low or high impedance.
- (4) T4 should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal shall not be kept at high impedance when the power is on.

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	12V	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current	I _L	6.0±0.5	mA
Oscillating Frequency (Inverter)	F _W	47±2	KHz
Vertical Frame Rate	Fr	60	Hz

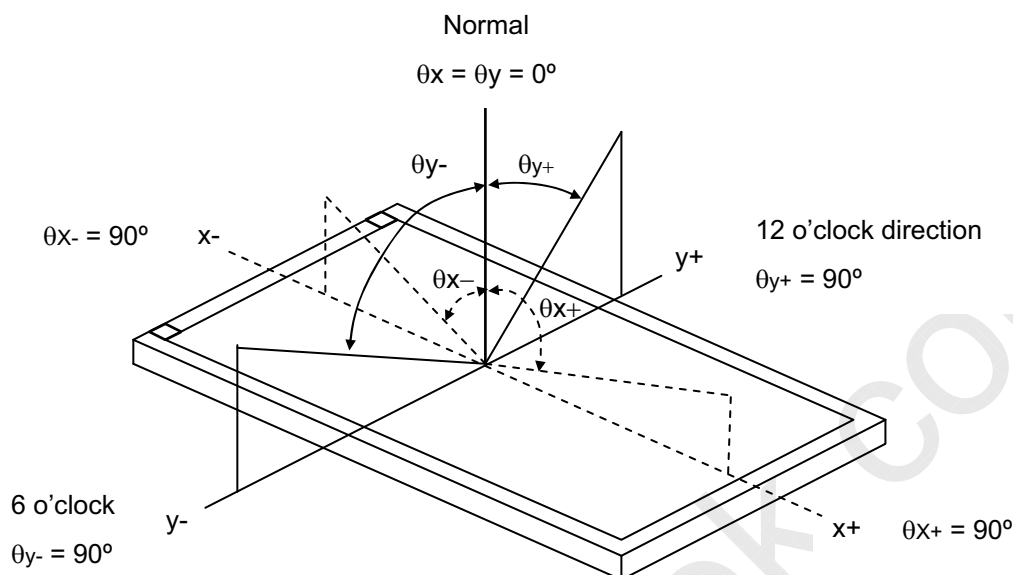
7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_Y=0^\circ$ Viewing Angle at Normal Direction	1800	2000	-	-	Note (2)
Response Time		Gray to gray		-	6.5	12	ms	Note (3)
Center Luminance of White		L _C		450	500	-	cd/m ²	Note (4)
White Variation		δW		-	-	1.3	-	Note (7)
Cross Talk		CT		-	-	4	%	Note (5)
Color Chromaticity	Red	R _x		Typ.- 0.03	0.638	Typ.+ 0.03	-	Note (6)
		R _y			0.331		-	
	Green	G _x			0.268		-	
		G _y			0.593		-	
	Blue	B _x			0.143		-	
		B _y	0.068		-			
	White	W _x	0.280		-			
		W _y	0.285		-			
	Color Gamut			70	72	-	%	NTSC
Viewing Angle	Horizontal	θ _x +	CR≥20	80	88	-	Deg.	Note (1)
		θ _x -		80	88	-		
	Vertical	θ _Y +		80	88	-		
		θ _Y -		80	88	-		

Note (1) Definition of Viewing Angle (θ_x , θ_y):

Viewing angles are measured by Eldim EZ-Contrast 160R



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

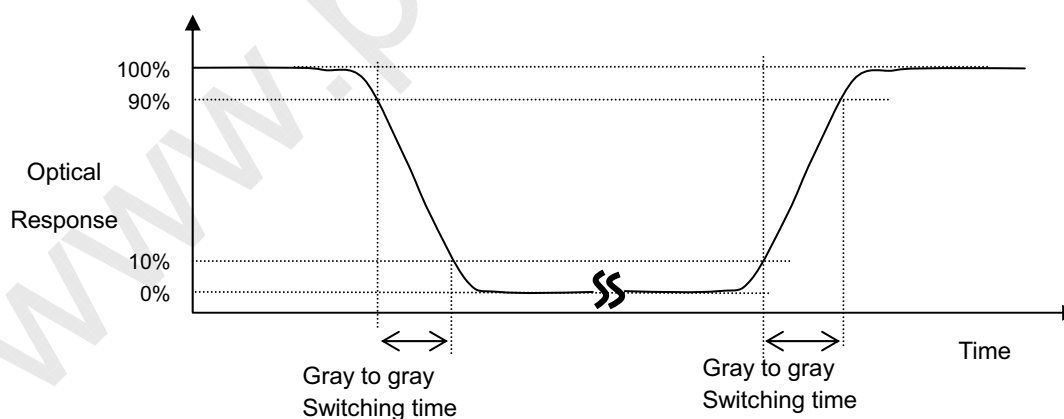
$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (7)

Note (3) Definition of Gray-to-Gray Switching Time:



The driving signal means the signal of gray level 0, 63, 127, 191, and 255.

Gray to gray average time means the average switching time of gray level 0, 63, 127, 191, 255 to each other.

Note (4) Definition of Luminance of White (L_C):

Measure the luminance of gray level 255 at center point.

$L_C = L(5)$, where $L(x)$ is corresponding to the luminance of the point X at the figure in Note (7).

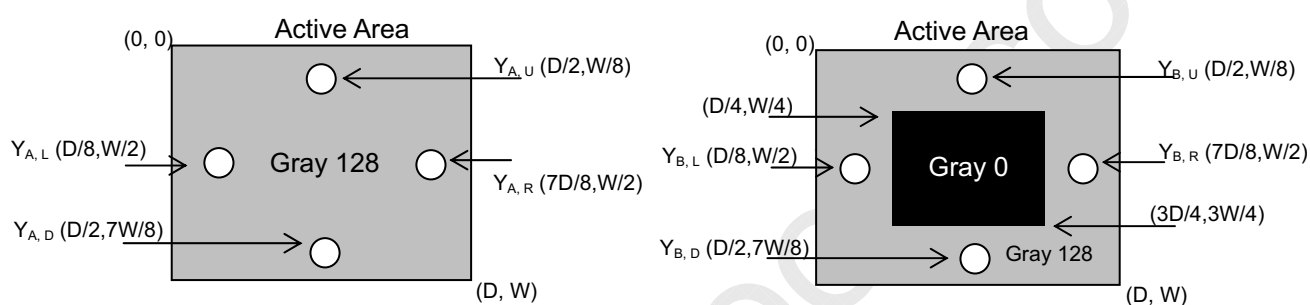
Note (5) Definition of Cross Talk (CT):

$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where:

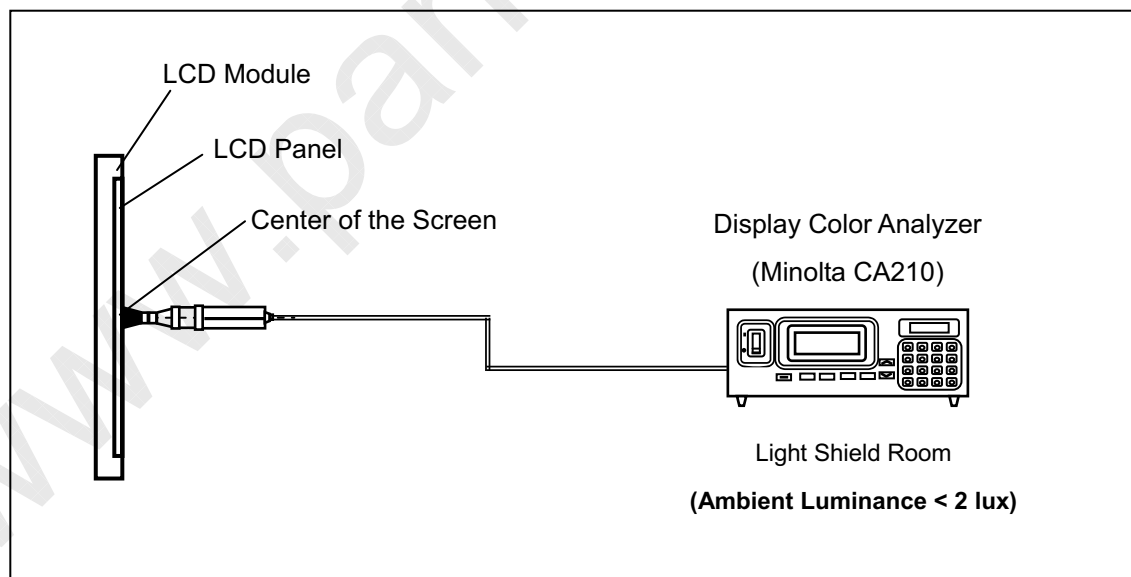
Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m^2)



Note (6) Measurement Setup:

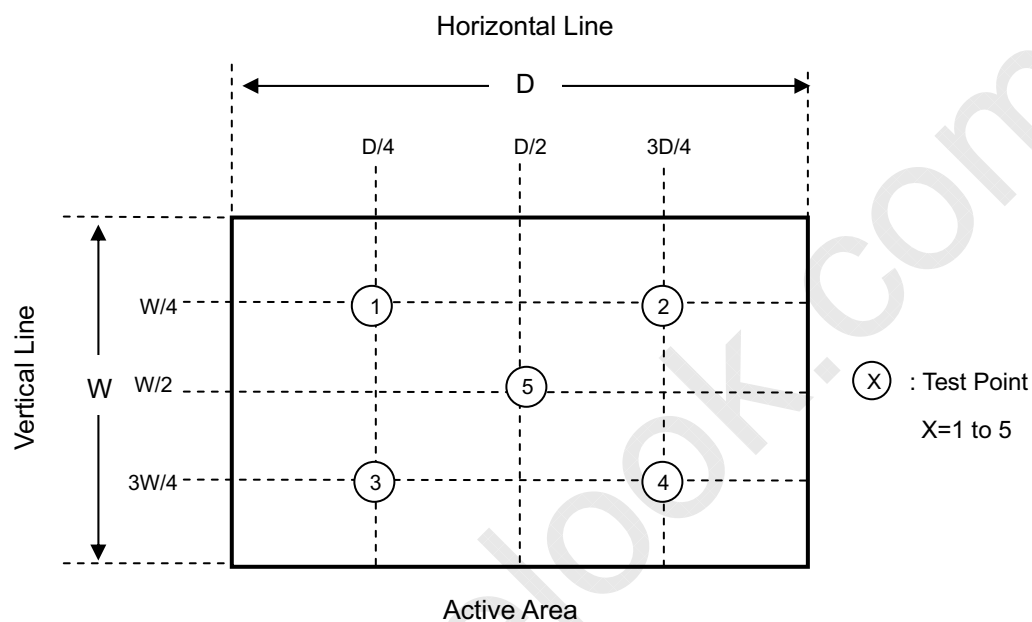
The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 1 hour in a windless room.



Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

$$\delta W = \text{Maximum} [L(1), L(2), L(3), L(4), L(5)] / \text{Minimum} [L(1), L(2), L(3), L(4), L(5)]$$



8. PRECAUTIONS

8.1 ASSEMBLY AND HANDLING PRECAUTIONS

- [1] Do not apply rough force such as bending or twisting to the module during assembly.
- [2] It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- [3] Do not apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.
- [4] Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- [5] Do not plug in or pull out the I/F connector while the module is in operation.
- [6] Do not disassemble the module.
- [7] Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- [8] Moisture can easily penetrate into LCD module and may cause the damage during operation.
- [9] When storing modules as spares for a long time, the following precaution is necessary.
 - [9.1] Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35°C at normal humidity without condensation.
 - [9.2] The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.
- [10] When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

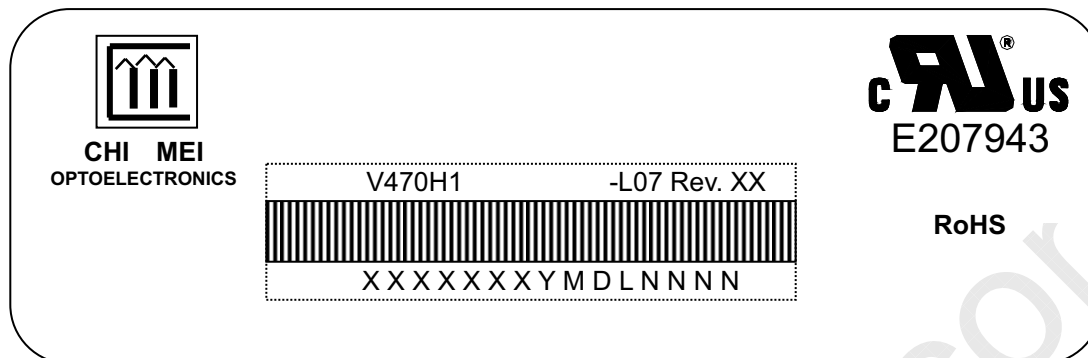
8.2 SAFETY PRECAUTIONS

- [1] The startup voltage of a Backlight is approximately 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the Backlight unit.
- [2] If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- [3] After the module's end of life, it is not harmful in case of normal operation and storage.

9. DEFINITION OF LABELS

9.1 CMO MODULE LABEL

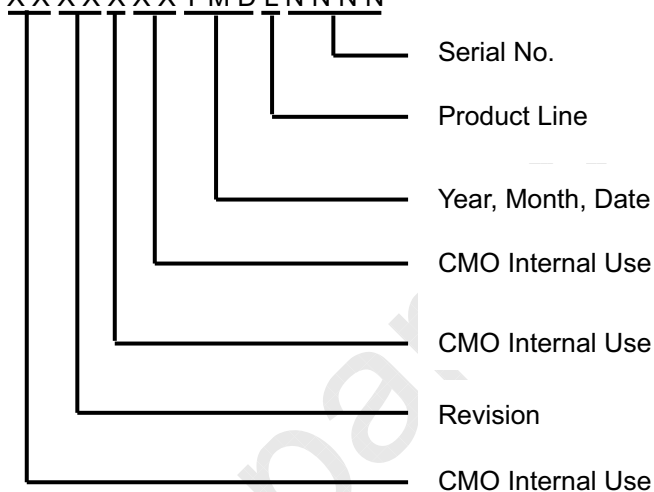
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



Model Name: V470H1-L07

Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.

Serial ID: X X X X X X Y M D L N N N N



Serial ID includes the information as below:

Manufactured Date:

Year: 0~9, for 2000~2009

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I, O, and U.

Revision Code: Cover all the change

Serial No.: Manufacturing sequence of product

Product Line: 1 -> Line1, 2 -> Line 2, ...etc.

10. PACKAGING

10.1 PACKAGING SPECIFICATIONS

3 LCD TV modules / 1 Box

Box dimensions: 1080(L) X 282 (W) X 685(H)

Weight: approximately 45Kg (3 modules per box)

10.2 PACKAGING METHOD

Figures 10-1 and 10-2 are the packing method.

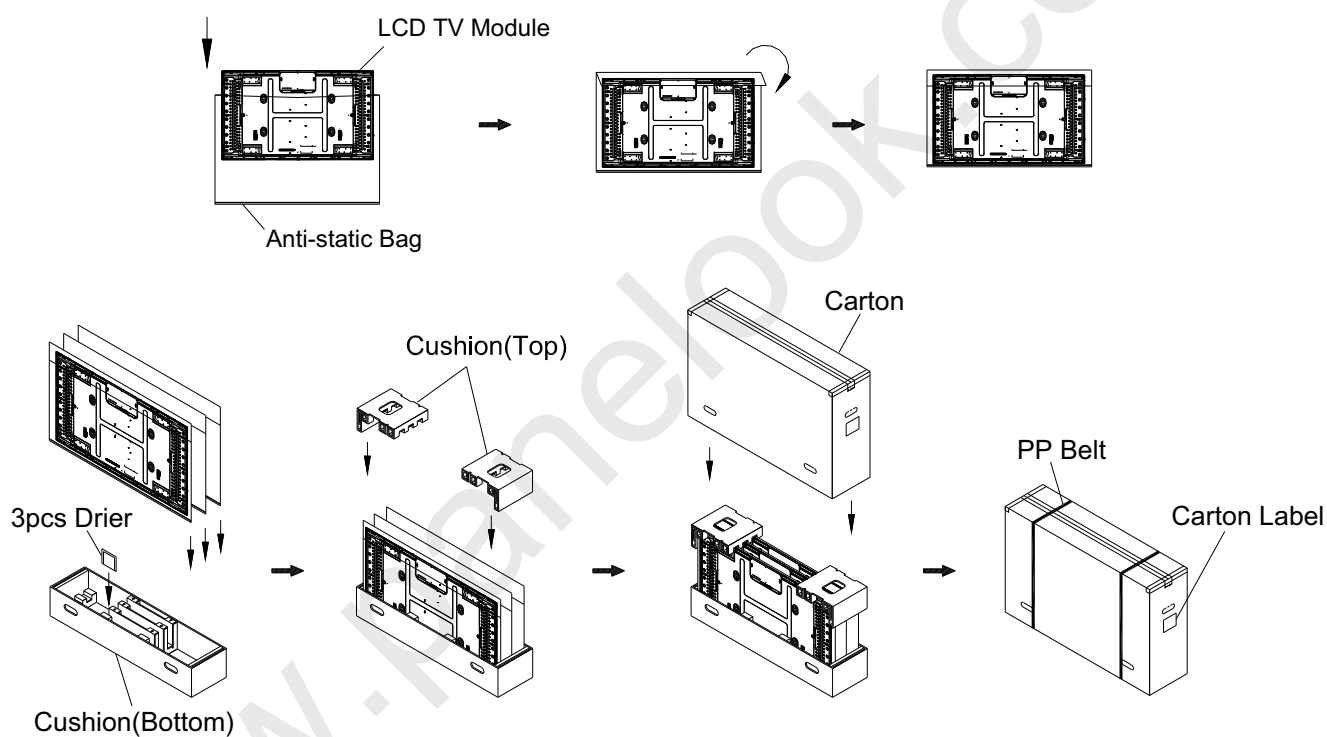


Figure.10-1 packing method

Sea / Land Transportation (40ft HQ Container)

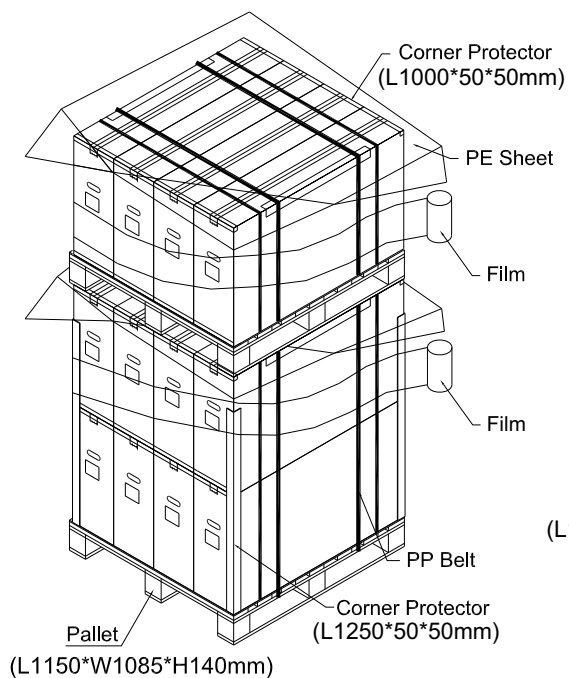
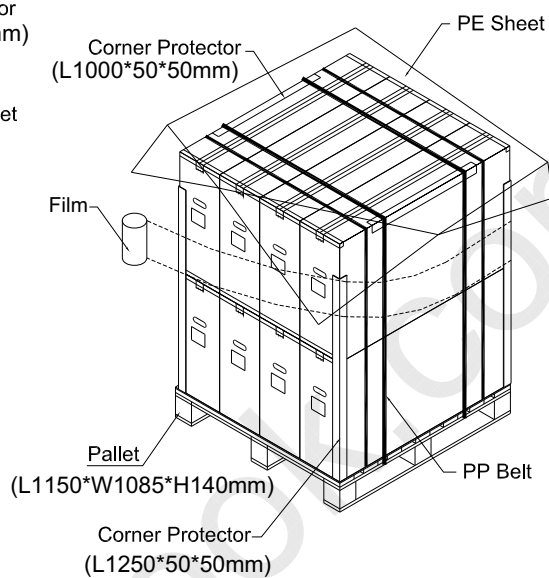
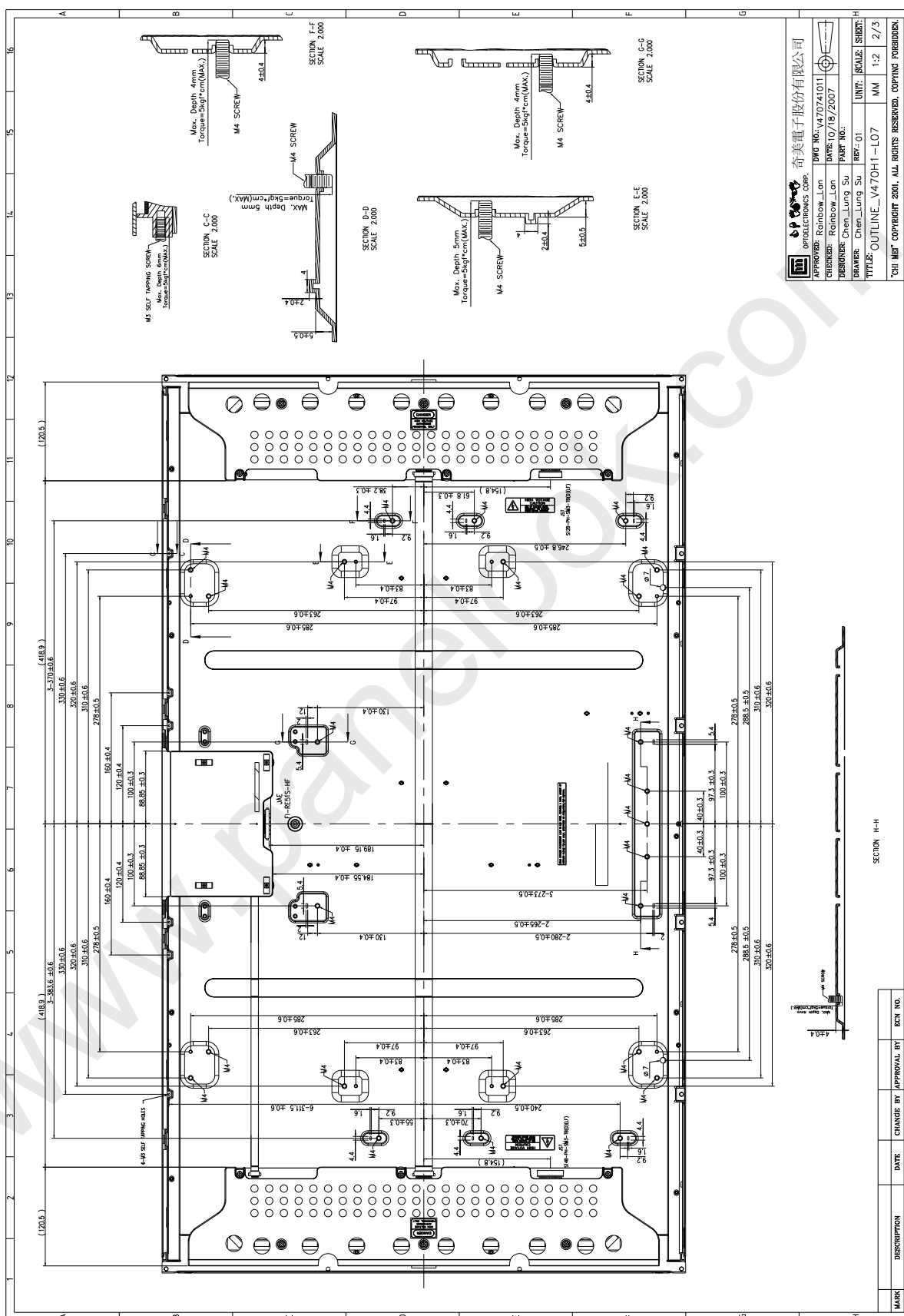
Air Transportation &
Sea / Land Transportation (40ft Container)

Figure.10-2 Packing method





**CHI MEI**
OPTOELECTRONICS CORP.

Issue Date: Dec.03.2007

Model No.: V470H1-L07

Preliminary